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NOTE

The object of this Bulletin is to present a factual and integrated picture of the plant pests and diseases situation in India and measures adopted to protect crops from their ravages. Any suggestions for the improvement of this Bulletin will be gratefully received.

HEM SINGH PRUTHI,

Plant Protection Adviser to the Govt. of India

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**N.B.*—Articles, Reports, Notes, etc., against which authors are not indicated, have been prepared in the Directorate of Plant Protection, Quarantine and Storage of the Ministry of Agriculture, New Delhi. Any correspondence relating to these items should be addressed to the Plant Protection Adviser to the Government of India, New Delhi. Correspondence regarding other articles should be addressed to the writers concerned.

COVER ILLUSTRATION

Spraying of potatoes against early blight in West Bengal

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A STUDY OF SYMPTOMATOLOGY IN INFESTATIONS OF SOME COMMON PADDY PESTS IN SOUTH INDIA

By E. R. Gopala Menon

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The study of symptomatology of pest attack is the most important aspect which concerns a Plant Protection worker. It is common experience that when ryots bring insect infested specimens of crops, the sample in many cases is quite devoid of any insects. A diagnosis leading to the identification of the causative organism has to be done purely on a symptomatic analysis of the attacked plants. The correct identification of symptoms assumes greater importance in cases where the susceptible period of the crop is restricted to narrow limits and where the primary insect damage is followed and masked by some secondary fungus attack. In such cases, when the damage becomes apparent, examination reveals the cause of only the fungus, an absolutely erroneous conclusion which may lead to the adoption of wasteful, uneconomic and ineffective control measures. A close observance and study of the symptoms of attack of all the important pests on their host plants is a necessary and unavoidable requisite for every Plant Protection worker.

The symptoms of attack of some of the common and important pests of paddy in South India, as observed during the course of work, are given below. It is not claimed that these are exhaustive ; further additions and modifications may suggest themselves to field workers in different parts of the country. A comprehensive study and compilation of such data will be of invaluable help to every scientist and field worker interested in Plant Protection.

(i) *Spodoptera mauritia* Boisduval

Symptoms.—Young nursery crops up to about three weeks old are completely eaten up to the roots, feeding usually proceeding in orderly manner, the margin of the attacked area being practically always regular with no zig-zagging. After about three weeks feeding becomes irregular, plants eaten up only about two-thirds, the bottom portion remaining as stumps.

(ii) *Thrips oryzae* Williams

Symptoms.—Nursery plants affected ; seedlings appear greyish with the leaf-tips dried up. Leaves show innumerable minute dots and scratches. In severe attack, outer leaves may also dry up in addition to the tips.

(iii) *Hispa armigera* Olivier

Symptoms.—Seedlings and plants up to two months after transplanting are affected. Leaves up to half of their length from the tip in older leaves and practically the whole leaf in seedlings appear glistening papery-white due to the feeding of the green matter of the leaves by the leaf-mining grubs. Though adults also feed by scraping the leaves, the principal damage is caused by the grubs.

(iv) *Leptispa pygmaea* Baly

Symptoms.—Plants from nursery stage to mature stages are affected. Tip drying is the first symptom followed by the drying up of all the leaves, the attacked leaves turning to hay-colour. The adults and grubs scrape the green matter of the leaves from the inside. A crop attacked immediately after transplanting fails to strike roots and the existing roots decay.

(v) *Nymphula depunctalis* Guenee

Symptoms.—Nurseries to half-grown crops are affected. In the younger plants, the outer leaves are first bodily eaten, the process commencing from the tip downwards to two-thirds of the leaf. The more centrally situated leaves are attacked at a later stage. Plants present a frayed appearance. As the crop becomes older and the leaves tougher, feeding is restricted to patchy scraping of the green matter, such areas appearing papery-white. An examination will easily reveal the difference between this and that caused by Hispa.

(vi) *Schoenobius incertellus* Walker

Symptoms.—In the nursery, the attack is characterized by yellow central shoots, a feature which may become apparent only on close examination. Such shoots come away easily on being lightly pulled up and show the based portion cut off. At later stages also, the same symptom of dead-hearts is indicated and the stem at the normal water-level in the fields indicates small holes through which the caterpillar has entered. The death of the central shoot stimulates tillering and attacked plants have a bunchy, stunted appearance, the latter being caused by the arrest of the growth of the primary tillers. At the stage when ears are formed, attacked plants show characteristic white ears, which stand formed, and which when pulled come off easily due to the basal portion being cut by the caterpillar.

(vii) *Cnaphalocrocis medinalis* Guenee

Symptoms.—The pest usually attacks the transplanted crop during the first month and a half to two months of its growth though in some cases even nursery plants of an advanced stage may also be affected. Attacked plants indicate the two margins of the leaf attached together for some distance and this portion is white in colour due to the scraping away of the green tissues from the inside. As the caterpillar grows, the entire leaf is folded back on itself at about the middle. In severe infestations, the adjacent leaves of the same plant or nearby plants may be all webbed together. At superficial glance this infestation is likely to be confused with that of Case-worm.

(viii) *Nephotettix bipunctatus* Fabricius

Symptoms.—Plants from the nursery to half-grown stage are attacked. In the nursery no symptoms are visible except when the infestation is exceptionally severe. In such cases, a general yellowing and stunted growth are the only outward signs. As these may be caused by other factors like soil defect, a field examination is

imperative before prescribing control measures. After transplanting, infestation is characterised by tip drying, drying of the outer leaves, general yellowing of the entire plant and stunted growth.

(ix) *Nilaparvata sordescens* Linnaeus

Symptoms.—The insects, though breeding on tender stages of the crop, do not cause any marked symptoms. The damage becomes evident in the mature crop, especially from the short-blade to the milky stage of the ears. The lodging of the crop is the first symptom, this being caused by the sucking of plant sap at the basal portion of the stem. Lodging is invariably followed by an acute development of Sclerotia and the drying up of the entire affected area. In the ears of attacked plants, empty, chaffy glumes are in abundance.

As the symptoms are not perceptible till a late stage, diagnosis and treatment must be prompt ana expeditious. No treatment is possible in a lodged crop and all attempts should be made to treat the adjacent crops which have not been affected seriously.

(x) *Pachydiplosis oryzae* Woodmason

Symptoms.—The insect attacks only late planted first crops. The attacked plants develop a long tubular structure, white, green or green tinged with violet, in colour, at the growing point, instead of producing the normal leaves. The symptom is characteristic.

In this case recognition of the causative organism is of no practical value, since the symptoms is an after-effect of infestation and when no curative treatment is of use.

(xi) *Ripersia oryzae* Green

Symptoms.—The infestation is noted in the transplanted second crop. The infested plants occur usually in patches and show arrested growth, with the older leaves of an unhealthy yellow tinge. The leaf-sheaths, when opened out, will show the bugs, coated in white mealy powder. Even when the insects are absent, the mealy covering persists, and can be easily observed.

(xii) *Tetroda histeroides* Fabricius

Symptoms.—The insect attacks all stages of the crop. Attacked plants show arrested growth, tip drying and a bunchy appearance due to excessive and unhealthy tillering. The top portions of leaves hang down from the place of attack, as if the mid-rib is broken at the point. When attacked plants produce ears, individual glumes, glistening white in colour will be present, being those damaged when inside the stalk before emergence.

(xiii) *Leptocorisa acuta* Thunberg

Symptoms.—The insect attack is confined only to the milky stage of ears. The individual grains are sucked dry and in an ear very few glumes escape damage. The attacked ears appear pale whitish-green in colour, are empty and do not bend down as the normal ears do when filled but stand erect.

(xiv) *Hieroglyphus banian* Fabricius

Symptoms.—This insect infestation occurs in growing stage of the first crop paddy. The nymphs feed upon the leaves which appear partly eaten, but due to the abundance of leaves, the crop is not affected in any way. Damage becomes evident when the short-blade stage synchronises with the production of the adult stage of the insects. When this happens, the insects nibble the basal portion of the ear stalk causing these to hang down. Such ears appear white in colour.

A close and detailed study of symptoms is of great practical value. It is hoped that this aspect will receive adequate attention of all Plant Protection Scientists.

PLANT PROTECTION WORK IN AJMER-MERWARA IN 1950

(i) Insect Pests

By G. N. Bhatia,

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1. The "Phadka" Grasshopper (*Hieroglyphus nigro-repletus* Bol.) Out of the total cultivated area of 218,450 acres during the Kharif season about 207,218 acres were infested with the pest. About 1,300 Mds. of egg pods had been removed by the cultivators in the off season. The infestation, due to the removal of egg pods, was reduced, but the control operations had to be done afterwards on these fields, as the cultivators could not trace all the egg-pods in their fields and the work of removal of eggmasses had not been done thoroughly.

About 400 Hand-dusting machines and four power-dusters were working in about 650 villages. One hundred and seventy centres had been fixed for the distribution of insecticides and the dusting machines. Total area treated was 119,500 acres (approximate), which comprises almost all the infested maize crop, 50 per cent of jowar, 25 per cent of bajra, 20 per cent of Sesamum and 5 per cent of cotton. The treatment consisted of dusting with 10 per cent BHC. Total insecticide issued was 428 tons. From the treated crops, about 305,408 mds. of grain and 582,500 cart-loads of fodder worth about rupees one crore seven lakhs are expected to be saved.

The pest was present in the uncultivated area and forests. It was roughly estimated that 197,000 acres of uncultivated area and 11,919 acres of forest area were infested in addition to the cultivated area. About 2,000 acres of uncultivated area and 1,500 acres of forest area adjoining the cultivated area were also treated, to save the grasses and forest plantations.

2. *Acorypha sp.*—This grasshopper was found at many places in association with *Hieroglyphus nigro-repletus* Bol. and at some places it out-numbered *H. nigro-repletus* Bol. It was present in the cultivated as well as uncultivated and forest areas. Against this grasshopper, baiting proved to be more economical when done at the proper time. The bait used consisted of, 1 maund of carrier (saw dust), 2 seers of BHC 10 per cent, 3 seers of gur and water sufficient to make the bait.

3. *Amsacta sp.*—(*Katra or Gujrat hairy caterpillars*).—Due to heavy rains during the season, the Katra hairy caterpillars appeared in virulent form. Many fields were affected severely. As all the Plant Protection staff at that time was very busy in the control of grasshoppers, adequate attention could not be paid to this pest. Hand-picking was recommended. Programme for the control of this pest has been included in the Plant Protection Scheme for 1951-52.

4. *Laphygma exigua*—(*Lucerne caterpillar*).—At some places Maize plants of 3-4" in height were attacked by this pest. Dusting the plants with 5 per cent BHC brought the pest under control and the plants recouped afterwards.

5. *Athalia proxima*—(*Mustard saw fly*).—Cauliflower seedlings, cauliflower plants and radish plants were seriously attacked. More than 50 beds were treated with 5 per cent. BHC in suspension at the rate of 1-2 oz. in one gallon of water. The next day the plants were sprayed only with water to wash away the residue of the insecticide. The pest was brought under complete control.

6. *Aphids.*—Aphid attack was reported in the vegetable gardens. Spraying with Agrocide wettable 1 : 400 gave good results. Aphids were reported on wheat plants also at a number of places. Spraying with tobacco decoction and nicotine sulphate 1:800 gave very satisfactory results.

7. *Field Rats.*—Field rats, which cause a serious damage to the seedlings and ears of wheat, barley etc., were controlled in an area of about 312 acres by baiting with Zinc phosphide and Strichnine hydrochloride and gassing the burrows with Cymag.

(ii) Diseases

By

M. M. Gaur, Plant Protection Assistant, Ajmer.

1. *Seed borne diseases* :—

(a) *During Kharif.*—Jowar seed was treated with Agrosan GN at the rate of 1½ chataks per maund for the control of grain smut (*Sphecelotheca sorghi*). A total quantity of 7,083 maunds of seeds were treated for the cultivators in different villages.

(b) *During Rabi.*—About 5,400 maunds of wheat and barley seeds were treated with Agrosan GN for the control of Foot-rot and covered smut.

2. *Virus disease of Guava.*—About 10,000 trees of guava in Pushkar valley have been observed to be affected by a smalling disease which is probably of virus origin. To prevent the spread of the disease to other orchards in the State, it was recommended that the affected trees should be uprooted and quarantine restrictions should be imposed upon the movement of guava planting material from the affected to non-affected areas. About 300 diseased trees in Pushkar area were cut down. As the growers were rather reluctant to destroy their trees, it was suggested that they might be given some compensation in respect of the trees destroyed. The provision for such compensation has, accordingly, been made in the scheme for 1951-52.

OBSERVATIONS ON NEW AND KNOWN DISEASES OF CROP PLANTS OF THE UTTAR PRADESH

By P. R. Mehta,

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Introduction

Observations on new and known diseases of crop plants of U.P. for the Rabi season 1949-1950 have been published previously in the Plant Protection Bulletin. This note is intended to review the disease situation for the Kharif season, 1950.

I. *DISEASES OF 'TIL' (Sesamum orientale)*

(1) *Anthracnose.* (*Colletotrichum sp.*).—Anthracnose disease of Til had not been noticed at Kanpur in previous years. This disease appeared on the '*Til*' crop at the Research Farm, Kanpur, in the first week of September. About 10-12 per cent plants were affected in the earlier sown crops, whereas the incidence was negligible in the late-sown crop. It is conjectured that the unusually early cessation of the monsoon this year did not permit the secondary infection in the late-sown crop.

Symptoms.—The disease appears in the form of round, oval or elliptical water-soaked lesions on the stem or axils of the leaf. Usually the spots do not completely girdle the stem, and consequently longitudinal streaks of dead tissues are formed. In many cases, due to coalescence of spots, streaks running the entire length of the main stem and involving the thinner secondary (fruiting branches) were observed.

The acervuli were present on the dead tissue. The conidia were sickle shaped. Most of the cultures of '*Til*' were affected with varying degrees of severity.

(2) *Stem-rot* (*Sclerotium bataticola—Macrophomina phaseoli*).—Many plants of '*Til*' which were prematurely dried up, were found to be affected with stem and root rot. The isolates from dead tissue gave cultures of *S. bataticola.* The disease appears late, as on many dead plants fully formed pods were noticed. Many shrivelled seeds has sclerotia of the fungus on their surface. It is suspected that the disease is seed-borne.

(3) *Powdery mildew* (*Oidium sp.*)—This disease appeared in a severe form only in the late sown crops. Perfect stage of the fungus was not observed.

(4) *Phyllody* : (Cause not known).—Observations regarding the incidence of this disease in relation to sowing date appear to be interesting. Earlier sown crops had a much higher incidence of the disease than the late sown crops. Similar observations have been

made in the previous years. The following table summarises the observations made at Research Farm. Kanpur for 1950.

Date of sowing	Percentage of plants affected with phyllody			
	Varieties of Til			
	T_{10}	T_{11}	T_{17}	Kalyanpur Local
June 18, 1950	29·0	46·0	49·0	49·0
July 3, 1950	3·0	7·0	48·0	4·0
July 22, 1950	2·0	4·0	5·0	4·0
August 17, 1950	0·5	1·0	2·0	1·5

II. *DISEASE OF GROUNDNUT* (*Arachis hypogea*)

(1) *Anthracnose.* (*Colletotrichum* sp.).—During 1950, about 15 per cent groundnut plants were affected with an anthracnose disease at the Research Farm, Kanpur. Acervuli of *Colletotrichum* sp. occurred on the dying shoots, leaves and stipules. The disease was reproduced by inoculation of the healthy plants by a pure culture of the fungus. Fifteen out of 63 cultures of the Economic Botanist (Oilseeds) to Government, Uttar Pradesh were unaffected by the disease.

(2) *Root-rot and stem-rot.* (*Sclerotium bataticola—Macrophomina phaseoli*).—This fungus was frequently isolated from dead or dying plants.

(3) *Root-rot.* (*Sclerotium rolfsii*).—This fungus occurs either alone or in combination with *S. bataticola* in diseased roots.

(4) "*Concealed damage*".—A large number of isolations were made from shells and pods of groundnut. From the shells, *Sclerotium rolfsii* was obtained. From discoloured pods, *Sclerotium bataticola* and *Rhizoctonia solani* were frequently isolated. These fungi are seed-borne. It, however, remains to be determined if these fungi, which are also common soil inhabitors, cause the disease through soil or through diseased seeds.

(5) *Tikka disease* (*Cercospora personata*).—This disease appears to cause losses in erect and late maturing types. In a replicated trial, laid down to study the efficacy of different fungicides (Bordeaux mixture, 2:2:50; Perenox; Dithane Z-78; Dithane D-14; and Sulphur dust) for the control of this disease, the best control was effected by 3 spraying of Bordeaux mixture or by 3 dustings of Sulphur. The average yield increased by about 50 per cent as compared to the control (No treatment). Perenox was also quite effective. Dithane Z-78 and Dithane D-14 were least effective in controlling the disease.

III. *DISEASE OF SANN HEMP*

(1) *Phyllody* : (Cause not known).—At the Research Farm, Kanpur, the incidence of this disease was noted on crops sown on different dates. As seen from the following data, the incidence of this disease was much higher on crops sown early (before the outbreak of monsoon).

Date of sowing.	*Incidence of disease.*
June 16, 1950	50 per cent.
July 8, 1950	4 per cent.

IV. *DISEASE OF BAJRA*

(1) *Smut of Bajra* (*Tolyposporium penicillariae*).

(a) *Control.*—Experiment conducted for the third successive year to test the effect of fungicides (Ceresan and Agrosan GN.) on the control of ' bajra ' smut gave inconclusive results. It is concluded that the disease is not seed-borne.

(b) *Estimation of loss caused by Bajra Smut.*—Since this smut affects only a certain percentage of the grain in a year the loss is difficult to determine. In order to determine the loss, heads of Bajra showing smut infection were graded into the following classes (depending upon the amount of infection):—

Very severe ; Severe ; Moderate ; Slight ; Traces. After the grading,, three heads were selected by random sample and the total number of diseased and healthy grains were ascertained by actual counting. The average of three heads for each class represented the percentage of diseased grains per head in that class. Since the number and percentage of diseased heads in each class is known, and the percentage of diseased grains per head for each class is also known, the total loss is easy to calculate.

The following data were obtained for the Bajra crop grown at the Research Farm, Kanpur.

Class	No. of heads in each class. (1)	Percentage of diseased heads in each class (2)	Percentage of diseased grains per head in the class (3)
Very severe	1	0·009	78·5
Severe	34	0·310	34·70
Moderate	108	0·988	12·90
Slight	406	3·713	1·40
Traces	1,126	10·279	0·14

Total number of Smutted heads in the field	1,675
Total number of Healthy heads in the field	9,260
Total number of heads in the field	10,935

Although about 15 per cent of heads were affected with Smut, the loss was determined to be only 0.3 per cent of the total yield.

V. *DISEASE OF JOWAR*

(1) Grain Smut (*Sphacelotheca sorghi*).

(a) *Survey of jowar smut in the U.P.*—Information on the subject is being collected. It was presumed that this smut is confined mainly to the trans-Jamuna tracts, but specimens of Smut have been received from 'Tarai' areas (near the Himalayan foot hills).

(b) *Control of grain Smut of Jowar.*—Experiments carried out in different tracts of U.P. for three successive years have proved conclusively that Agrosan GN is very effective in controlling the disease. Ceresan also gave good results, but not equal to that of Agrosan GN.

(c) *Testing varieties for resistance to grain Smut of Jowar.*—Out of 20 varieties tested for resistance to Smut (Smut collections from U.P. were mixed up for inoculum), only two varieties appeared resistant, viz., 31B and 4101.

VI. *DISEASES OF PADDY*

(1) *Ufra disease* (*Anguillulina angusta*).—Unlike previous years (see Plant Protection Bulletin Vol. I, No. 1), this disease has been either absent or existed in a very mild form this year. Reports of serious damage have not been received from any source.

(2) *Bunt* (*Neovossia horrida*).—As in the previous years, this bunt was reported from the Rice Research Station, Nagina. The following varieties were affected :—

T.136, T.65, T.112, A.65, T.45, T.12 and T.21.

T.136 appears very susceptible, as bunt is reported on this variety every year.

VII. *DISEASES OF Colocasia antiquorum*

(1) *Blight.*—This disease caused by *Phytophthora colocasiae*, occurs throughout the plains of Uttar Pradesh. Usually the disease appears rather late in the season and consequently the losses are not appreciable. This year (1950), the blight was severe in the Fatehpur District.

(2) *Petiole-rot.*—In very damp weather, the *petioles* of colocasia are often affected with *Sclerotium rolfsii* and *Colletotrichum* sp. A large number of leaves consequently fall down.

VIII. *DISEASES OF POMEGRANATE*

(1) *Fruit-rot.*—A serious fruit-rot disease of Pomegranates was reported in July from Bulandshahr District. Immature and semi-mature fruits were affected. The disease started from the Calyx end and gradually extended to the entire fruit. On the diseased area, pycnidia of a fungus (*Phomopsis* sp.) appeared in large numbers. Pycnidia of the same fungus were found on lesions on leaves. The secondary spread of the fungus was considerably checked by one spraying with Perenox (with albolinium as a sticker). On the unsprayed trees almost all the fruits rotted away.

IX. *DISEASE OF GUAVA*

(1) *Die-back and wilt disease.*—This disease was first of all observed in the district of Allahabad in 1935. During the 15 year period it has spread over a wide area and assumed serious proportions. Since 1945 it seemed to have spread with unprecedented suddenness and has become a potential threat to thousands of valuable guava orchards. Important visible symptoms are withering of the lower most branches of a tree from tip downwards one after another till the whole tree wilts ; the sapwood and roots turn dark in late stages.

Distribution.—The disease commonly occurs in the mid-eastern districts of U.P. An extensive survey is being continued. From the information so far obtained the disease has been observed to occur in 12 mid-eastern districts of the State in different degrees of severity ranging from about 5 per cent to about 30 per cent. Western districts are practically free from the disease.

Incidence.—The wilting is observed in the majority of fruit trees during the rainy season and may continue up to December. In almost all cases disease symptoms are evident only in trees that have reached the fruiting stage. Both seedling and grafted plants of the guava varieties commonly grown in U.P. appear to be susceptible to disease.

Damage.—As the wilted trees are cut down and removed as soon as they die, it is not possible to know the exact extent of damage. However, on the basis of random surveys, it is estimated that approximately 5-10 per cent are being killed every year. New plants are being put to replace the gaps, but since the new plants will come to bearing stage after a couple of years, the immediate loss to the orchardists is enormous.

Casual organisms.—Species of *Cephalosporium*, *Fusarium* and *Pestalozzia* are commonly obtained among the isolates from affected stem and roots. During rainy season profuse masses of pink spores of *Cephalosporium* sp. are often observed in between the cracked bark of the affected guava trees.

Analyses of soil from places having high incidence of disease and from disease free ones have shown some correlation between the pH and the disease incidence. Areas having a soil pH near about 6.0 are disease free. Alkaline soils having a pH 8 or above have incidence of the disease.

Since the method of natural initial infection of the guava plants and the subsequent spread of the disease are still unknown, no methods of control can be advocated at this stage. Cutting down the affected trees, removing the stumps and burning them would, however, be helpful, to check the spread of the disease to some extent.

(2) *Anthracnose.*—(*Colletotrichum psidii*).—The anthracnose of guava is a serious trouble in the rainy-season crop in this State ; the winter crop is rarely affected.

Varied types of symptoms have been observed to occur on the fruits from different localities. Species of *Colletotrichum* have always been obtained from affected fruits. The disease was first reported from the Agra District. This year a serious out-break of this disease was reported from Agra in August. There is some evidence that the disease persists on mummified fruits in which the fungus perennates. Control measures should be directed towards removal of these mummies which persist on the trees throughout the year. Investigations on this disease are in progress.

X. *MISCELLANEOUS DISEASES*

White rust (*Cystopus ipomoae*) of *Ipomoea repens.—Ipomoea repens* is an aquatic plant and grows commonly in ponds, ditches etc.. during the rainy season (July to September). Its leaves and tender twigs are commonly used as vegetable. Blisters on leaves and galls on stem caused by white rust have been frequently observed at Kanpur.

Zonate spot of Fig.—Cephalosporium fici has been observed on zonate spots on leaves of *Ficus carica.* This fungus has also been recently reported from U.S.A.

INCIDENCE OF IMPORTANT DISEASES IN SOME OF THE IMPORTANT ECONOMIC CROPS AT THE I.A.R.I. AND ITS SUB-STATION AT KARNAL DURING 1949-50

By R. S. Vasudeva,

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The crops grown at the Indian Agricultural Research Institute Farm and its Sub-Station at Karnal are surveyed for disease incidence frequently throughout the season. The incidence of a few major crop diseases as observed during 1949-50 *Rabi* season in the important foodgrain crops is given below :—

Wheat

Loose smut (*Ustilago tritici*) was observed in almost all the wheat plots at the I.A.R.I. Farm and the infection ranged from 1-3 per cent. The variety Punjab C.518 showed comparatively greater disease incidence than other varieties (N.P.12, N.P.710, N.P.715, N.P.718, N.P.721, N.P.760 and Cawnpore 13). At the Karnal Sub-Station the disease was found only in traces in C.518. The remaining wheat varieties (N.P.4, N.P.12, N.P.52, N.P.165, N.P.710, N.P.715, N.P.718, N.P.721 and Cawnpore 13), that were being grown there showed only sporadic cases of smut infection.

Flag smut (*Urocystis tritici*) was found only in a few isolated plots at the I.A.R.I. The incidence of the disease in most of the infected plots was merely in traces, but in a 5-acre block of variety C.518 the infection varied from 5-15 per cent in different plots. The lowest infection was observed in N.P.165. At Karnal, the varieties C.518 and N.P.52 showed 3-4 per cent infection, whereas N.P.165, N.P.710, and C.228 were found to be free of Flag smut.

Rust.—The Yellow rust made its appearance early in the season 16.1.50) at Delhi and persisted for a long time. The varieties chiefly affected were N.P.12, N.P.715, N.P.718, N.P.758, N.P.762, N.P.764, C.518 and Cawnpore 13. The incidence of infection ranged from 80-100 per cent and the intensity of rust attack was medium to severe. N.P.165 remained free from infection and N.P.775, N.P.760, N.P.720, C.591 and C.228 showed infection in traces only despite their close proximity to heavily rusted plots. N.P.710 and N.P.721 showed light infection. It might however be mentioned that in some heavily manured plots the incidence of rust infection was observed to be slightly higher, which is not unexpected. At Karnal also the incidence of Yellow rust this season was high. Wheat varieties N.P.52, N.P.125, N.P.715, N.P.758, N.P.762, and N.P.764 showed heavy infection ; N.P.12 showed moderate infection ; C.518, N.P.710, N.P.718 and N.P.720 showed traces-light infection ; whereas N.P.737, N.P.760, N.P.775 and C.591 had infection in traces only. N.P.4, N.P.80-5, N.P.165 and C.228 remained free from Yellow rust infection.

The Brown rust infection was very light this year at Karnal and merely in traces at Delhi.

The Black rust appeared very late in the season (15.2.50) at Delhi and the varieties N.P.12, N.P.165, N.P.720 and N.P.762 showed moderate infection; N.P.715, N.P.718, N.P.721, N.P.737, N.P.745, N.P.761, C.228 and C.518 showed light-moderate infection; N.P.760 and C.591 showed traces of light infection; whereas N.P.710, N.P.758, N.P.764 and N.P.775 had infection in traces only. At Karnal N.P.125 and C.518 were heavily infected with Black rust. N.P.12, N.P.80-5, N.P.165, N.P.720, N.P.761, N.P.762, C.228 and C.518 showed moderate heavy infection. N.P.4, N.P.5, N.P.718, N.P.737, N.P.735, N.P.764 and N.P.775 showed light-moderate; whereas in N.P.710, N.P.715, N.P.758, N.P.760 and C.591 the infection was in traces only.

Barley

Loose smut (*Ustilago nuda*) and *Covered smut* (*Ustilago hordei*) infection varied from 1-2 per cent at Delhi in N.P.13, the only variety grown whereas the crop at Karnal was found to be free from either smut.

Rust.—There was only a light infection of both the Yellow and the Black rust of the barley crop at Delhi and the only variety (N.P.13) grown showed 60-80 per cent incidence of both the Yellow and the Black rusts, but the intensity of infection was light. At Karnal only Black rust was observed in traces in N.P.29 only. N.P.13, the other variety grown alongside, remained free from rust.

Oats

Smut.—The entire Oat crop both at Delhi and Karnal was free from both the Covered and the Loose smut infection.

Leaf spot (*Helminthosporium avenae*).—Secondary infection of the disease was observed in traces both at Delhi and Karnal oat crop. Little primary infection was observed at either place.

Rust (*Puccinia graminis*).—Sporadic cases of uredostage of the rust were noticed on the glumes very late in the season at Delhi. The pustules did not attain a size larger than pinhead.

Gram

Wilt (*Fusarium orthoceras*) incidence in the Gram crop at Delhi varied from 2 to 10 per cent in N.P.58, the only variety grown. In the crop at Karnal Sub-Station the wilt incidence varied from traces to 5 per cent in N.P.58, 6-7 per cent in N.P.28, 5-6 per cent in N.P.53 and 2-3 per cent in G.24 and N.P.29.

Rust (*Uromyces ciceris—arietini*) infection varied from traces to light. N.P.58 was the only variety affected out of the 5 varieties grown at Karnal Sub-Station. At Delhi the rust made its appearance very late in the season when the crop was turning yellow and was found only in traces in N.P.58, the only variety grown.

Peas

Powdery Mildew (*Erysiphe polygoni*) appeared rather late at Delhi but spread rapidly, resulting in 100 per cent infection of the

crop (N.P.29, the only variety grown). At Karnal the Mildew incidence in the peas crop was found to vary from 60-80 per cent in N.P.29, the only variety grown.

Rust (*Uromyces fabae*) was absent both at Delhi and Karnal this year in the Pea crop.

Control of Loose Smut of Barley and Grain Smut of Jowar by Solar Heat Treatment

The solar heat treatment recommended by Luthra for the control of loose smut of Wheat (*Ustilago tritici* (Pers.) Rostr.) has also in preliminary tests been found to be effective in controlling the loose smut of Barley (*Ustilago nuda* (Jens.) Rostr.).

The treatment consists in soaking the seed, collected from smutted crop, in water for four hours on a hot sunny day in June and then exposing the soaked seed to the sun on a brick-floor 10 A.M. to 5 P.M. The temperature of the floor during this period varied from 114.8° to 129.2°F., but for a short while touched 132.8°F. The germination of the seed is slightly impaired by the treatment, but it should be possible to make up the reduced germination by increasing the seed-rate.

In the case of grain smut of Jowar (*Sphacelotheca sorghi* (Link) Clint.) the same treatment as is mentioned above, and certain modifications of it were tried. In one of modifications the infection percentage in the resulting crop was found to be 0.5 per cent, as against 12.5 per cent in the untreated control, showing thereby that it may be possible to utilize solar heat treatment for controlling the Grain smut of Jowar.

Fungicidal Seed Treatment

A field experiment was conducted during the year 1949-50 to study the effect of various seed treatments on maize crop. Out of the various fungicides tried, seed treatment with Agrosan GN, Barbak, Copper Carbonate, Semenon and Aagrano gave statistically significant increase in stand over the control.

In another preliminary laboratory experiment on the relative efficiency of different fungicides as seed dressings of wheat showed appreciable increase in germination of the treated seed over the untreated controls, the actual germination (per cent) figures being, control 78, Agrosan GN-90, Spergon-92, Semenon-97, Ceresan-86, Barbak-89, Aagrano-88, Mersolite D-80 and Mersolite P-83.

NOTES ON TWO IMPORTANT PLANT DISEASES IN BOMBAY STATE.

By M. N. Kamat and M. K. Patel,

Office of the Plant Pathologist, College of Agriculture, Poona.

A disease locally known as "Agarbatti" caused by *Ephelis oryzae* has been noted in this State on paddy crops since 1920. The disease, which was hitherto present in sporadic form all over the tract, however, appears to be increasing in intensity year by year in certain localities, and reports about its appearance and incidence have been received from Dharwar, Belgaum, North Kanara, Kolhapur and Kolaba Districts during this year. The disease appears to be specially common in finer varieties such as Basumati, Kamod and Kolamba 42. The incidence of the disease in experimental area in N. Kanara during the year is estimated at 9-11 per cent; in general, however, it has not exceeded 1-2 per cent in most tracts. The life history of the fungus is not precisely known and requires thorough investigation in view of the increasing incidence of the disease in the Bombay State.

Bunchy top of banana, a virus disease has been recently recorded in this State, and is rapidly spreading to important banana growing centres such as Khandesh, Poona and Surat. A recent survey has shown the following incidence of the disease viz., Khandesh 25-70 per cent, Poona 10-15 per cent, Surat 25-30 per cent. The disease is likely to take dangerous proportions and ruin important money and food-giving industry of the State unless immediate measures are taken to control it. Since quarantine, roguing and eradication offer the only effective methods of eradication, the State Governments have been approached for a joint scheme with the centre for this purpose.

THE REACTION OF THE VARIOUS WHEAT VARIETIES AGAINST RUST DURING 1949-50

The following is a summarised account of the reaction of the various wheat varieties against rusts, based on reports received from the different states.*

Kashmir.—The wheat varieties, Ford, Shiver, Sword, Barinja, Big Beraha, Kacha, N.P. 4, I.P. 12, I.P. 80-5, I.P. 120 were sown. Excepting Ford, which was comparatively resistant, other varieties were susceptible to the three rusts of wheat, black, brown and yellow.

Jammu.—The two varieties, C.951 and 'Desi' were sown. Information regarding their reaction against rusts was not available.

* Information from Uttar Pradesh and Madhya Pradesh has not been included in this issue, as it was not received up to the time of sending this article to the press.

Punjab.—Of the varieties, C. 591, C. 518, C. 284, C. 283, C. 282, C. 281, C. 250, C. 228, C. 217, 9 D and 8 A, C. 591, C. 228, C. 217 & 9 D were susceptible to all the three rusts ; C. 282 and C. 281 proved to be highly resistant to Black rust, C. 284 and C. 283 moderately so, while C. 250 and C. 228 proved susceptible to black rust. C. 283 and C. 281 were moderately resistant to yellow rust.

Himachal Pradesh.—The following varieties of wheat were sown : Local, C. 591, N.P. 4, N.P. 80-5, N.P. 165 and N.P. 770. Not much information was available about their reaction to rusts.

Rajasthan.—Of the varieties Desi and C. 591, Desi proved susceptible to black rust. C. 591 was not rusted except in one locality viz., Bichla (Ajmer).

Bihar.—The following varieties were sown :—

N.P. 552, 710, 745, 758, 766, 775 and varieties 164, 164B, 166, 319, 350, H. 10. Local Dudhia, Jamnia and Australian wheats.

The varieties 350 and 49 proved highly susceptible to brown rust. Others, viz., 164, 164 B, H.10, N.P. 52 Local Jamali and Dudhia were susceptible in general. The varieties 319 and 166 exhibited partial resistance to the same.

Assam.—Local varieties were sown and they were susceptible to black and yellow rusts.

Bombay.—Chandausi, Sarbati, Popatia, Kathia, Gulab Motia, Vijay, Local red, Jaya, Modhya, Wajia and Niphad 4 varieties were sown.

Popatia was resistant to brown rust, whereas Wajia was susceptible ; Sarbati was comparatively less susceptible than Wajia. No other information was available about the reaction of other varieties against rusts.

Hyderabad.—Of the varieties, N.P. 4, Kanpur '13, Bansi, Rohilla, Potya, and Local, all proved susceptible to black rust. Bansi and Rohilla were susceptible to brown rust. The reaction of other varieties against the brown rust was not known.

Madras.—Of the varieties local Samba and Pusa, the former was resistant to black rust, it was, however, susceptible to brown and yellow rusts.

Black rust was observed only on Pusa varieties in a small plot in village Sholada.

WHEAT RUST SITUATION IN INDIA DURING 1949-50

The following is a summarised account of the wheat rust situation in India, during 1949-50, as reported by the different state authorities.*

Kashmir.—All the three rusts of wheat, Black, Brown and Yellow were reported from Kashmir. Yellow appeared earliest. The severity of the three rusts was as follows :—

Black	...	...	...	23 per cent.
Brown	...	...	...	31 per cent.
Yellow	...	...	...	46 per cent.

Jammu.—Yellow rust appeared in Jammu early in March. Information regarding the severity of rusts etc. was not available.

Punjab.—The three rusts of wheat, black, brown and yellow appeared in Ferozepore, Jullundur and Gurdaspur districts. Yellow rust appeared earlier. The first outbreak of rust was reported in January from the Gurdaspur District. In other localities it was reported towards the end of February or in March. None of the three rusts were virulent. Comparatively, the black rust was more severe. The maximum severity of the three rusts, as observed in Ferozepore, was as follows :—

Black rust	...	...	...	10-100 per cent.
Brown rust	...	...	...	10-25 per cent.
Yellow rust	...	...	...	25-65 per cent.

In Jullundur and Gurdaspur districts the attack of all the three rusts was very mild. Only brown rust appeared in Hissar and there was no report of any rust from Rohtak, Gurgaon and Karnal.

Himachal Pradesh.—All the three rusts were reported from Himachal Pradesh. Yellow rust appeared earlier in a majority of the localities. It appeared in the 1st week of January in Sirmur District. In other localities it appeared in February, except in Bhattiyat (Chamba district), where the brown rust was first noticed in the third week of March.

The severity of the rusts as reported from Sirmur district was as follows :—

Black rust	...	...	...	10-20 per cent.
Brown rust	...	...	...	Traces.
Yellow rust	...	...	...	75-80 per cent.

Rajasthan.—Black rust appeared in traces to 5 per cent in the first week of March.

Bihar.—Black and Brown rusts appeared in North Bihar and were of a mild severity, except at the Bahadurpur Farm, where the severity was 30 per cent. In South Bihar no rusts appeared. In other areas of Bihar viz., in Patna and in Bhagalpur Divisions, Black and Brown rusts appeared. In the Patna division the maximum severity of rusts was 15 per cent. In the Bhagalpur division, except in South Bhagalpur, where no rusts appeared, the severity of rusts ranged between 5 and 25 per cent.

* Information from Uttar Pradesh and Madhya Pradesh has not been included in this issue, as it was not received up to the time of sending this article to the press.

Assam.—Black and Yellow rusts were reported from Khasi and Jaintia hills with severity as follows :—

Black rust	40 per cent.
Yellow rust	10 per cent.

Bombay.—Black and Brown rusts were reported from Bombay. Black appeared earlier. The severity of rusts was, however, light.

Black rust	10-25 per cent.
Brown rust	Trace-10 per cent.

The initial outbreak of rusts was reported in the third week of November. Heavy showers were recorded in October, thereafter the weather was dry for most of the period.

Hyderabad.—Black and Brown rusts were first observed in the 2nd week of December in Hyderabad State with severity as follows :—

Black rust	10-50 per cent.
Brown rust	Less than 5 per cent.

There was much rainfall prior to sowing but the weather was dry afterwards.

Madras

Nilgiris.—All the three rusts of a rather mild severity were reported from Ootacamund. The brown rust was observed in the 1st week of January, the black in the second week and yellow in the last week of January with severity as follows :—

Black rust	15-20 per cent.
Brown rust	5-10 per cent.
Yellow rust	5 per cent.

Black rust was observed only in Pusa varieties sown in a small plot in village Sholada.

Plains.—The three rusts were reported from the Coimbatore, Madura and Salem districts of Madras. Except in Salem, the attack of rusts was rather mild with severity between 20 and 30 per cent. In other districts, viz., in Bapatla, Cuddapah, Bellary and Nellore districts no rust was recorded. The weather was mostly dry during November and December.

TREATMENT OF JOWAR SEED (ANDROPOGON SORGHUM) IN DELHI STATE DURING 1949

By S. P. Atri,

Plant Protection Assistant, Delhi.

For the first time during the summer of 1949, jowar seed (*Andropogon sorghum*) of Malwa variety received from Madhya Bharat by the Delhi Administration, for distribution to the cultivators, was given fungicidal treatment. Though the cultivators in the beginning failed to realise the importance of this because of the notion that the crops raised from such seeds might adversely affect health of cattle, yet necessary propaganda is being continued and the cultivators are being explained the benefits of seed treatment.

About 1875 maunds of jowar seed was treated in five villages, which was distributed to about 750 cultivators and was sown in about 4,000 acres. The fungicidal dust used for the treatment was Agrosan GN at the rate of 2½ ozs. for each maund of seed. On an average, 40 maunds of jowar seed was treated per day with one seed treating drum and two men working for 8 hours. The cost of treatment is calculated as follows :—

1. Two labourers @ Rs. 3 per day.	Rs. 6-0-0
2. Cost of Agrosan GN for treating 40 maunds of jowar seed.	Rs. 7-11-0
3. Depreciation of the seed treating drum ...	Rs. 0-1-0
Total : ...	Rs. 13-12-0
Cost of treatment per acre.	Rs. 0-2-0 approx.

Some of the interested cultivators treated their seed themselves. Thus, omitting the cost of labour, the cost is only about one anna per acre.

The crops raised from treated seed in all localities were regularly kept under observation. The germination in all places was above normal and the crops raised from treated seed showed in general better tillering and complete absence of smut (*Sphacelotheca sorghi*), whereas in crops raised from untreated seeds the incidence of the disease varied from 10 to 15 per cent, being more severe in the low-lying areas of the State. As the crop is raised mainly for fodder purposes, the comparison of grain yields could not be ascertained. However, the cultivators in general agreed that higher yields of fodder were obtained from the crops raised from treated seed and they were greatly satisfied with the results achieved by sowing such seed.

CONTROL OF PLANT DISEASES IN THE NORTHERN REGION OF THE MADRAS STATE IN THE YEAR 1949-50

By P. Govinda Rao,

Crop and Plant Protection Officer, Mycology, Bapatla.

Paddy.—Paddy nurseries in the North Visakhapattanam district, Nellore and Chittoor are in certain years appreciably damaged by the occurrence of Blast (*Piricularia oryzae*). Spraying of nurseries with 1% Bordeaux mixture is being carried out in these districts for the prevention of the disease. An area of 162 acres of nursery was sprayed during 1949-50. Blast also appears in the transplanted crop when spraying is not effective. With a view to evolving varieties resistant to blast a Rice Research Station was started at Buchireddipalyem in Nellore district in the year 1937. Two selections B.C.P. 1 and B.C.P. 2 were brought out from the local susceptible variety Molakolukulu and they are under distribution in the districts of Nellore, Chittoor, and the adjoining taluks in Guntur and Cuddapah districts. About 582 tons of seeds of resistant varieties enough to transplant an area of 52,400 acres were distributed to the ryots. Taking an average increase of 5% in yields, it is estimated that there has been an increase of 1,871 tons of grain as a result of this measure.

Another important disease, which occurs in paddy is Foot-rot caused by *Fusarium moniliforme* var *majus*. This is confined mostly to the three districts, East and West Godavari and Krishna, although its occurrence was reported from Kurnool and Nellore districts also. Leaf spot (*Helminthosporium oryzae*) is a normal occurrence in all the districts. Foot rot and primary infection of *Helminthosporium* disease are easily prevented by treatment of seeds with a fungicidal dust. Though the cost of the treatment is negligible (about one anna per acre of transplanted crop) the ryots were not freely adopting this measure as the effect of the treatment could be observed only after one or two months. The Madras Government were, therefore, pleased to sanction an amount of Rs. 2,400 for the purchase of the fungicide and free demonstration to the ryots in the initial stages.

In view of the facts that seed treatment controls the two diseases, and also improves the stands in the nursery, it was considered advantageous to make this operation a routine practice in all the districts. Conferences of the Agricultural Demonstrators were held in all the districts, and the advantages of the seed treatment were explained and sufficient quantities of the fungicide were distributed. It is worthy of note that nearly 714 tons of paddy seeds were treated and distributed over an area of about 40,000 acres. This is expected to result in a saving of nearly 2,291 tons of paddy.

Jowar.—Jowar (*Andropogon sorghum*), another important food crop, suffers about 2 per cent loss in yield due to grain smut caused by *Sphacelotheca sorgni*. The maximum loss goes up to 50 per cent in certain localities. Treatment with sulphur for the prevention of

Smut is now a common practice with the ryots. The Agricultural Department has stocked sulphur in all the taluk Agricultural depots and the dust is sold to the ryots during the sowing periods in packets of 2 or 4 ozs. During this year a total area of 4,58,262 acres was sown with treated seeds. This is expected to result in a saving of 2,291 tons of grain.

Korra (*Setaria italica*).—'Korra' is a food crop, which is affected by the smut disease (*Ustilago crameri*). This is, however, mostly confined to Bellary and Anantapur districts. Seed treatment with sulphur was carried out as a preventive measure against the disease, and an area of 16,300 acres was sown with treated seed in these districts, resulting in a saving of 82 tons of grain.

Turmeric.—Turmeric is grown in the Cuddapah, East Godavari, West Godavari, Krishna, Guntur, Nellore and Kurnool districts. In all these districts, it is subjected to the leaf spot caused by *Colletotrichum capsici*. Two sprayings with Bordeaux mixture (1 per cent) were found to be effective in checking this disease. A total area of 621 acres was treated during this year.

Tobacco.—Northern region of the Madras State is noted for the cultivation of Virginia tobacco and nearly two lakhs of acres are under this crop. Nurseries for this are raised in the coastal area of the Guntur district in a concentrated belt. Damping off caused by *Pythium aphanidermatum* is a normal occurrence every year and ryots undertake spraying with Bordeaux mixture to prevent this disease. During this year 509 acres of nurseries were sprayed.

Citrus.—Of the citrus diseases Foliocellosis or mottle leaf caused by the deficiency of zinc in soil is a normal occurrence in all sweet orange gardens. Spraying with zinc sulphate-lime mixture was carried out and an area of 970 acres or 58,227 trees were treated during this year. A saving of 485 tons of fruit is expected as a result of this measure.

Gummosis, die-back, canker and collar-rot resulting in the sudden wilting of the trees are the other diseases met with in this region. An area of 460 acres or 27,618 trees were treated against these diseases and saving of 230 tons of fruit is estimated.

A new disease called Felt caused by a species of *Septobasidium* occurred in the West Godavari district as an epiphytotic during this year. Trials with fungicides, like Bordeaux mixture or Perenox or limasul have shown that the disease can be controlled by two sprayings. An area of 50 acres was sprayed during this season as a result of which an additional yield of 25 tons of fruit is expected.

Other crop diseases against which control measures were adopted on small areas are onion blight (*Alternaria palandui*), fruit rot of chillies (*Colletotrichum capsici*), damping off in chilli nursery (*Pythium aphanidermatum*), Panama wilt of plantain (*Fusarum* sp.), mildew on vegetables, etc.

Summary of Foreign Plant Quarantine Regulations of Ceylon

Summary of Plant Quarantine Regulations of Ceylon is given below for the information of nursery-men, Plant Quarantine officials and others interested in the export of plants and plant products from India to that country.

Serial No.	Commodity affected	Pest and diseases whose entry is being restricted.	Degree of prohibition on import	Date of proclamation of order or ordinance.
1	Seeds or plants of Hevea (any species) from Western Hemisphere.	S. African leaf disease. *Melanopsammopsis* (*Dothidella*) ulei (Henn) Stahe.[1]	Total Prohibition ..	Plant Protection ordinance No. 10 of 1924 and Extract from Ceylon Gazette No. 8 399 of September 30th, 1938.
2	Seeds of plants of Hevea (Any species) from Eastern Hemisphere.	..	Importation restricted except under permit in writing from the Director of Agriculture to be previously obtained.	Do.
3	Tea seed directly or indirectly from any place in India.	Blister blight *Exobasidium vexans* Mass.	Total Prohibition	Do.
4	Coconut plants (*Cocos nucifera* L.)	Coccids.	Total prohibition	Do.
5	Coconuts (*Cocos nucifera*) in husk except through the port of Colombo.	..	Total prohibition	Do.
6	All living trees, plants,[1] tubers, roots, bulbs or portions thereof with the exception of potatoes, onions, turmeric and culinary seed and vegetables imported for consumption together with the packages, cases, pots or coverings in which they may be packed.	..	Importation restricted. [2] Consignments must be accompanied by a certificate from a country having recognised plant protection service, to the effect that the material is free from diseases and pests. Post packages must have attached to them copies of the certificate issued by recognized plant quarantine services ; the stuff will have to be examined by Quarantine Inspector incharge of Colombo fumigatorium and unhealthy plants will be fumigated.	Do.

[1]. ' Plant ' shall include all members of the Vegetable Kingdom whether living or dead or any part or parts of such, but not include canned or preserved fruits or vegetables.

[2]. Authorized ports of entry : *Colombo* and *port of Talaimannar*.

Summary of Foreign Plant Quarantine Regulations of Ceylon—contd.

Serial No.	Commodity affected	Pest and diseases whose entry is being restricted.	Degree of prohibition on import	Date of proclamation of order or ordinance.
7	Cotton seeds (all species of *Gossypium*).	The Boll weevil *Anthonomus grandis* Boh.	Total prohibition	
8	Sugarcane setts	Mosaic diseases ..	Total prohibition	
9	Water hyacinth (*Eichornia crassipes* Solms), including the seed and every part of the plant.		Total prohibition.	Water hyacinth ordinance 1909.
10	Cassava (*Manihot utilissima*), any living part of the plant.	Mosaic diseases	Importation prohibited except under a written permission from the Director of Agriculture.	Art 2 of General Regulations page 3.
11	Plant packed with soil or compost other than mulch.	..	Importation by persons other than Director of Agriculture prohibited unless it can be completely removed from the plant and subjected to sterilisation.	Regulation published in Ceylon Government Gazette, No. 90362 of February 2, 1945.
12	Fresh fruits	Mediterranean fruit fly (*Ceratitis capitata* Wied.), or any other pest of fruits which has not become established in Ceylon is known or suspected to exist in the country of export.	Director of Agriculture should be satisfied that the fruit is so treated as to insure that such pest in all its stages is effectively destroyed. Certificate of origin of consignment is necessary. Only licensed importers can import.	
13	Fresh fruits	..	May be imported only under a licence issued by the Director of Agriculture, or by an authorised officer of the Department of Agriculture and importation must be in accordance with the condition of such licence.	Art 2 of General Regulations, page 3. Letter of Director of Agriculture, Peradeniya, Ceylon November 1, 1938.
14	Sweet potatoe, tuber or portion thereof.	..	Importation from Africa prohibited.	Plant Protection Ordinance 9(2) chapter 307, 1945.

PLANT PROTECTION NOTES AND NEWS

Control of Market Diseases of Fruits and Vegetables*

Considerable spoilage of fruits and vegetables takes place since they are harvested, through the period of their packing, shipping, marketing, until they are finally consumed in the homes or processed and canned in the factories. Under ordinary method of transportation under refrigeration, over 2 per cent of fruits and 3.5 per cent of vegetable decay in the course of transportation to whole-sale by the decay of 10 to 15 per cent of fruits and vegetables is suffered by the retailers, while another 10 to 15 per cent loss is borne by the individual consumers due to spoilage that develops after the produce is bought but before it is finally consumed.

It is natural that spoilage would take place in these days when fruits and vegetables are grown in remote specialised parts of the country but shipped, sold and consumed in distant towns and cities. But modern science provides enough knowledge and skill to cut down appreciably such spoilage in fruits and vegetables.

The major market diseases of fruits and vegetables are :

(1) Blue Mold Rot, (2) Gray Mold Rot, (3) Rhizopus Rot and (4) Apple Scab.

Control of Market Diseases.—Since many of the market diseases of fruits and vegetables have their inception in the field, effective control of market diseases should start with an endeavour to grow healthy produce and to control the diseases, if any, right in the orchard or the field. But the rots and decays that develop in course of grading, packing, shipping and retailing can be successfully controlled by the following measures :—

Careful handling.—Care in harvesting is one of the most important ways to prevent physical injuries, bruises, etc. Many fungi and bacteria need injured surface to gain entrance before they are able to set in rot. A little care in harvesting, packing and handling pays immensely in preventing decays later. Equally important is the cutting of diseased ones before the fruits and vegetables are packed and shipped.

After-Harvest Treatment.—Fungical and bactericidal chemicals are added to water before the fruits and vegetables are actually washed before packing. Borax is commonly used in washing vats to prevent rots of citrus fruits. Chemicals, such as hypochlorites, free chlorine, etc., when added to washing fluid reduce bacterial and fungal decays.

Such treatment as painting of the freshly cut end of pine-apple with benzoic acid prevents later development of black rot of the fruit, while pasting of stem-end of watermelon with copper sulphate checks the stem-end rot of melons.

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* Diseases of Fruits and Vegetables found in the Market and Means of Controlling them. *Econ. Bot.* Vol. 4 ,No. 2, pp. 177-91, 1950.

Several chemicals with fungicidal and/or bactericidal properties are often commercially used in gas form in transit cars or in storage rooms. Nitrogen trichloride gas is extensively applied to freshly harvested oranges to prevent subsequent development of blue mold rot and green mold rot, and decays of cantaloupes and tomatoes. Carbon dioxide gas is similarly used to prevent spoilage of grapes. Carbon dioxide is also extensively used to prolong storage life of apples. The storage life of certain varieties of apples can be doubled thereby.

Use of wrapping papers and cardboard paper box impregnated with volatile fumigant, such as diphenyl successfully prevents the development of blue mold and stem-end rots of oranges.

Operation against cutworm *

Prompt action has saved a fine crop of large lupins, a valuable stock fodder, from destruction by cutworms in Western Australia, where 3,000 acres of plants were recently dusted with DDT powder from a low-flying aircraft.

Farmer E. Smart of Northampton, had a fine stand of lupins which he estimated would carry about ten sheep to the acre for three to four months of protein-rich feeding during the dry summer months. The crop, however, became so badly infested with cutworms that he feared a 90 per cent loss of sheep feed unless he could check the pest.

An Anson aircraft was chartered to spray the 3,000 acre area. The powder used was 2 per cent DDT and the balance an inert filler used to obtain the required dissemination. The dust was used at the rate of 15 lbs. to an acre. Cost of spraying worked out at nine shillings and six pence an acre.

Use of Chlorinated hydrocarbons for Ant Control†

The most important ones of the newer insecticides tested against ant control have been DDT, DDD, Methoxychlor, Toxaphene, Benzene hexachloride, particularly as Lindane, Chlordane and more recently Dieldrin. Control measures with these insecticides are still very largely in the formative stage. None of them has yet withstood the test of time.

Most of the chlorinated hydrocarbons are available as (i) dusts; (ii) wettable powders of sprays; (iii) emulsions; (iv) solutions and (v) aerosols.

Outdoor treatment.—Because of the many hazards, the chlorinated hydrocarbons should be used with great care. Consideration must be given to the effect, the treatment will have on soil, plants, beneficial insects and wild life. Excessive dosages have caused injury to plants. Benzene hexachloride on many occasions has imparted a flavour to vegetables and fruit. It is usually a good practice to use the lowest effective dosage and limit the application

* Australian Agricultural Newsletter, Release No. AGN/315, dated December 13, 1950.

† *California Agriculture*, Vol. 4. No. 8. August, 1950.

of chlorinated hydrocarbons to the ground of the trunk of shrub or tree. Even the repeated and heavy general application of chlorinated hydrocarbons in the garden should be avoided because there is a danger that these insecticides may accumulate in the soil to a point capable of injuring susceptible plants.

Effective dusts for outdoor application contain 1 to 10 per cent of active ingredient. These when injected into the nests of certain species such as carpenter ants, bring about an effective control.

Wettable powders and emulsions are useful in outdoor ant control. The former usually contain 20 to 50 per cent and the latter 25 per cent of active insecticide. The amount of actual material used for 100 gallons of water ranges from half a pound to 1½ lb. In treating ant hills or nests in garden higher concentration can be used. With some species it is desirable that the insecticide be applied directly to the nest. A small amount of concentrated spray should be poured into the nest and the remainder of the garden treated with the dilute spray. Wettable powders are less likely to cause injury to plants than emulsions.

Indoor treatment.—Main consideration is the residue spoiling the interior decorations. Chlordane solutions have an advantage over DDT solutions in this respect that they do not leave a crystalline residue. Since the question of plant injury does not arise, higher concentrations can be used for longer residual action. Solutions usually contain 2 to 10 per cent of the active material depending upon the chlorinated hydrocarbon used. Proper application is all-important, if effective control is to be expected. Within buildings the insecticide should be placed along runways and other places of invasion, such as under cabinets, along baseboards of closets and pantries. It is important to treat pipes under foundations and other paths of entry into structure.

The most common causes for failure of effective control by chlorinated hydrocarbons can be summarised as below :—

1. Improper selection of insecticide against a particular species.
2. Use of improper formulation of an effective substance. For example, a wettable powder used as spray may be very effective while the same insecticide used as dust may not at all be effective.
3. Use of chlorinated hydrocarbons in combination with alkaline materials, such as certain fungicides and emulsifying agents.
4. Improper compounding of effective insecticides e.g., wrong solvent used or improper grinding etc.
5. Improper application viz., mist spray where coarse spray should have been used.
6. Use of wrong type of equipment for application.
7. Insufficient dosage.
8. Application under unfavourable weather conditions.

Control of the Red Hairy Caterpillar

Successful control of the Red Hairy Caterpillar can be achieved by organising an efficient and timely campaign on co-operative basis and over a wide area.

In the control of *moths*. light traps consisting of some strong light such as lanterns, gas lamps, etc., placed in the middle of shallow vats containing water with a thin layer of oil on top, should be set up immediately on the night following the first heavy shower of monsoon rain. One gas lamp of about 200 candle power can serve to attract moths within an area of about 15 acres and they are trapped and killed. *Eggs*, which are generally conspicuous on the leaves should be hand-picked and destroyed. *Caterpillars* can be killed by digging trenches about 8 inches deep and 10 inches wide between fields and filling the trenches by weeds attractive to the caterpillars for feeding. These are swept into a heap and destroyed. *Pupae* can be killed by deep ploughing and crushing them, or on exposure they are eaten away by the birds.

Spraying the infested vegetation with 0.1 to 0.2 per cent DDT and dusting 50 per cent BHC solution will effectively kill the caterpillars.

Cabbage Moths (*Plutella maculipennis C.*) and Cabbage White Butterflies (*Pieris rapae L.*)

The caterpillars or grubs of the common cabbage moth and the caterpillars of the white butterfly have been recorded developing in large numbers and causing considerable damage to cabbage, cauliflower, brussels sprout, kohl-rabi, radish, turnip, mustard sweet alyssum, garden stocks and wall flowers.

For controlling cabbage moth caterpillars dusting of a 2 per cent DDT dust is recommended, and the spray, a DDT emulsion diluted to give a concentration of 0.1 per cent DDT i.e., DDT emulsion (20 per cent) 2 pints, water 50 gallons (3 fluid oz. to 4 gallons). In the seed beds the plants should be treated each week and after planting out every seven to 14 days according to amount of infestation. Cauliflowers must not be treated with DDT after curd commences to form.

Fall Armyworm (*Laphygma frugiperda* A. & S.) Control

A 2 per cent parathion dust at 35 lb. per acre gave complete control of the fall armyworm *Laphygma frugiperda* A & S., and it is the only insecticide tested that consistantly killed larvae deep within the maize buds.

Soil fumigation : Methyl Bromide vs. Weeds and Pests [4]

Excellent control of weeds as well as nematodes and insect pests was obtained by applying Dowfume MC-2 (methyl bromide

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[1] *Indian Farming*, Vol. X, No. 12, pp. 552-554, 1949.

[2] *Agricultural Gazette*, New South Wales LIX. Part 4, pp. 203, April 1948.

[3] Pest Control Abstracts, Vol. 1 No. 7. July 1950.

[4] Down to Earth, Vol. 4, No. 4, pp. 2-5, 1949.

plus 2 per cent chloropicrin) to outside beds under a gas-proof cover at rates of ½ lb. to 2 lb. per 100 sq. ft. for 24 or 48 hours exposure.

Spring Tails (Collembola) and Benzene Hexachloride [1]

Although they are usually found in swarms about various seeds, which have failed to germinate, or decayed, or in damaged bulbs and corms, Spring-tails under certain conditions, may attack various kinds of seeds planted in the soil or destroy the growing tips of recently germinated seeds and the delicate foliage of growing plants.

DDT has been found ineffective against these, when applied on soil surface. Nicotine sulphate and soap solutions or lime sulphur solutions have been of some help.

A benzene hexachloride-spray at a concentration of 0.1 per cent sparingly applied gave a week's protection without harming the plants. The Hexaethyl tetra phosphate at 0.4 per cent was not at all effective. Both Napthalene and Paradichloro-benzene were effective, when mixed in the straw at the rate of 2 oz. per square foot.

Aphids

Aphids or plant lice inflict severe losses in vegetable crops like cabbage, turnip, peach, potato, bean and melon, etc.

For aphids on hardy plants, soap sprays are very useful. Five cubic inches of ordinary soap to a gallon of water and this solution when diluted with equal quantity of water, can be used on tender plants also. On turnips, linseed oil-soap dissolved in water at the rate of one lb. to ten gallons is best.

Rotenone (proprietary products) insecticides are fairly effective against most aphids, but not against cabbage aphid.

DDT sprays and dusts are effective against green peach aphid and spinach aphid ; but DDT should not be used on young tomatoes, cucumbers, melons and squash as there is likelihood of its burning and stunting the growth.

Nicotine sulphate 40 per cent and often mixed with soap for better results is the commonest for use against aphids.

Nicotine dusts give the best results but demand very skilful and careful operation without which great damage will result.

Greater efficiency in Harvesting Rice Achieved with use of 2, 4-D in America's Rice Bowl States [2]

More rice, greater efficiency on harvesting the crop, and less costly drying operations are the predictions of agricultural experts

[1] The New South Wales Agricultural Gazette, LIX, part 1, p. 45, 1948.

[2] Processed Publication, Series No. 82 (Entomology) Dominion Entomological Laboratory, Chatham, Ont. Ottawa, Canada, 1948.

[3] Agricultural Newsletter (Du Pont), Wilmington, Del. Vol. 13, No. 5, p. 88, September-October, 1950.

for the America's rice bowl in Louisiana, Texas, and Arkansas, as a result of increased use of chemical weed killers.

Used to a limited degree in the past several years, 2, 4-D applications to control weeds in rice fields are becoming almost a standard practice.

Destruction of Mexican weed, indigo, red root, lilies, tie vines and other weedy plants enables the crop to make its best growth for a top yield. At the same time, combines or binders are able to operate at greater speeds and get all the grain from a clean, ripe crop free of Green weeds, and the rice is found to dry faster, due to freedom from wet, green weed seeds and pots.

Chemical Control of Lantana

Hormone weedkillers are more effective and preferable to arsenicals in the chemical control of lantana. Although 2, 4, 5-T formulations give better kill, Methoxone or the sodium salts of 2, 4-D are preferable, in view of the preliminary brushing or burning necessary in dense bushes and the comparatively lower cost of the latter (about ½ of the former). The best time to spray is when there is an abundant leafy regrowth. The hormones should be applied in fine warm weather as subsequent rain in a few hours lessens greatly the effectiveness of the spray. While for small patches or in very hilly country knapsack sprayers are more convenient, power sprayers with engines developing pressures up to about 300 lb. per square inch, with one or two hoses, each carrying one or two nozzles delivering a solid cone-shaped spray are preferable. All parts of the equipment used should be washed about three times in warm, soapy water (with preliminary rinsing in kerosene if esters had been used) and then left to soak over-night in water to which household ammonia has been added at the rate of one quart to 25 gallons of water.

Prefabrication Enables Safe, Speedy Erection of Grain-storage Bins*

An unusual method is being used in the United States to build bins for storing the nation's important grain reserves. Circular storage structures are being assembled in four important corn-producing states under a programme of the Commodity Credit Corporation, an agency of the U.S. Government.

The structures, made of sheet steel and aluminium, are prefabricated and delivered to the site by railroad cars, ready for assembly on cement foundations on "foundation rings". The metal parts of the proof are assembled first, and then bolted to the top ring of the side sheeting. The top ring is lifted by hoists high enough above the ground, so that the next ring of side sheeting can be attached. Additional rings are added in the same way.

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[1]Queensland Agricultural Journal, Vol. LXXI, Part 1, pp. 26-27, 1950.

* "American Newsfile Agriculture Superintendent" No. 50-A-23, December 6, 1950.

The foundation ring is primarily a 22-inch extension of the bin with a 4-inch steel flange bolted horizontally on to the base of the extension. After installation 15 inches of the ring are below ground level. The weight of the earth on the foundation ring flange anchors it solidly in place. The bin then is bolted on to the top of the ring. Seven inches of sand or dirt fill is added inside the bin to bring the loose metal bin floor up to the level of the original bin base and well above ground level.

This construction technique enables workmen to perform all assembly tasks on the ground rather than on scaffolding. Thus they can do their work with greater safety and speed. Four men can erect a bin in one day.

The circular bins hold up to 6,000 bushels of corn. Engineers of the U.S. Department of Agriculture helped to design the bins and develop the erection technique.

Taphrina padi (Jacz.) Mix.

The fungus causing a leaf curl on *Prunus padus* was considered by Butler and Bisby to be *Tephrina pruni*. Recently Dr. P. R. Mehta, Plant Pathologist to the Government of the Uttar Pradesh, found a Taphrina causing leaf curl in apricots. He writes that on a critical examination he finds this *Taphrina* to be *Taphrina padi* (Jacz.) Mix.

The Onion Thrips

The Onion thrips (*Thrips tabaci* L.) is frequently a serious pest of onions in most onion-growing areas. They seriously attack cabbage, cauliflower, kale cucumber. melon and tomato, weeds, but they prefer onions to all these.

Five per cent dusts of Chlordane or DDT may be used at the rate of 20 to 35 lb. per acre depending on the plants and the thickness of the stand.

Effective sprays are two lb. of 50 per cent wettable chlordane or DDT powder in 40 gallons of water and applied at a pressure of 125 to 150 lb. and at the rate of from 75 to 150 gallons of spray per acre according to size of plant.

San Jose scale control

Control measures for San Jose Scale, *Quadraspidiatus perniciosus* Comst., are best directed against second-instar larva which is the only stage that survives the winter. Complete control is not possible as larvae settle under the mother scales, especially the last-born larvae at the end of the vegetative period. A single summer spray of 0.03 per cent E 605 (Parathion) killed up to 91.9 per cent after 9 weeks and gave 78.4 per cent control in December but two or three carefully timed sprays are needed to build up persistence on the bark and ensure the best results. The addition of wetting agents seems promising.

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[1] "*Processed Publication Series No.* 106 (*Entomology*)" Dominion Entomological Laboratory, Chatham, Ont. Ottawa, Canada, 1948.

Hofchen Briefe 1949, (1), 18-25.

Red Scale (Aonidiella aurantii)

Sprays recommended for red scale are white oils and red oils. White oils are better and are used in a dilution of one gallon of oil to 40 gallons of water (16 fluid oz. to 4 gallons).

Application of two half-strength oil sprays (1 to 80) is better than single double oil sprays (1 to 40).

The 'Pot' method, the 'Dry' method and the method in which liquified hydrocyanic acid gas is sprayed into the tent space are the usual methods of fumigation

Treatment for the control of red scale is compulsory under provisions of the Plant Diseases Act in New South Wales.

Food crops and wild animals

Mr. R. C. Morris of Honnamethi estate, Mysore, writes that a Wolseley Electric Fencer can be used with success in keeping elephants and other animals out of crops. This simple unit is produced by the Wolseley Sheep Shearing Co., in the U.K., and is a very compact little affair. Either an inert 6-volt battery available from the same Company or an ordinary car battery can be used with the apparatus. It is found a single line of electrified barbed wire, set about 3 feet from the ground round the cultivated area was sufficient to keep elephants and sambhur out. To keep Chital and pig out, 2 lines of unelectrified barbed wire under the electrified line at 2 feet and 1 foot may be added. The current is, naturally, only switched on at nights. The shock, though not dangerous, is quite appreciable ; about equal to that felt on contact with an automobile plug wire. It is essential, of course, to make a periodical inspection of the wire to ensure that no jungle growth, twigs, etc., are touching the line as such will tend to gradually short-circuit the battery. Elephants which attempted to raid ragi fields, protected by the 'electric fencer' on four occasions, were repelled on contact with the wire each time ; twice an elephant was 'stung' on its trunk first and then, swinging round, got it on its backside and pushed off.

Spraying of Potatoes in Khasi and Jaintia Hills

Serious late blight outbreaks occurred in potatoes, grown during the summer months of 1950, in Khasi and Jaintia hills. Large scale sprayings with fungicides were conducted by the State Plant Protection staff to control the late blight. About 1,100 acres of summer potatoes were thus sprayed. This has increased on an average the yield of potato crop, thus sprayed, by 20 maunds per acre i.e. increased the average yield by about 30 per cent.

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[1]*New South Wales Agricultural Gazette,* Vol. LIX, PART 1, pp. 43-45 (Jan. 1, 1949).

[2]*The Planters' Chronicle,* Vol. XLVI, No. 2, p. 34, Jan. 15, 1951.

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